Claims:

1. (Previously Amended) A method for performing optical imaging or light-based treatment of at least a first tissue in an animal, comprising providing into the blood associated with said at least a first tissue a biologically effective amount of a low-scattering, oxygen-carrying blood substitute, wherein the low-scattering, oxygen-carrying blood substitute is selected to substantially reduce optical scattering from the blood fraction whilst substantially maintaining tissue oxygenation, and applying an optical imaging or light-based treatment step to said at least a first tissue.

2. (Original) The method of claim 1, wherein said low-scattering, oxygen-carrying blood substitute is a substantially non-particulate hemoglobin solution.

3. (Original) The method of claim 2, wherein said hemoglobin solution is a substantially non-particulate, homogeneous, acellular hemoglobin solution.

4. (Original) The method of claim 2, wherein said hemoglobin solution comprises bovine, porcine, ovine or primate hemoglobin.

5. (Original) The method of claim 2, wherein said hemoglobin solution comprises human hemoglobin.

6. (Original) The method of claim 2, wherein said hemoglobin solution comprises recombinantly produced hemoglobin.

7. (Original) The method of claim 2, wherein said hemoglobin solution comprises crosslinked hemoglobin.

8. (Original) The method of claim 2, wherein said hemoglobin solution comprises polymerized hemoglobin.

9. (Original) The method of claim 2, wherein said hemoglobin solution comprises glutaraldehyde crosslinked, polymerized hemoglobin.

10. (Original) The method of claim 2, wherein said hemoglobin solution comprises surface modified hemoglobin.

11. (Original) The method of claim 2, wherein said hemoglobin solution has a hemoglobin concentration of at least about 70% of the hemoglobin concentration of whole blood.

12. (Original) The method of claim 1, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 10%.

13. (Original) The method of claim 12, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 5%.

14. (Original) The method of claim 13, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 4%.

15. (Original) The method of claim 14, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 3%.

16. (Original) The method of claim 15, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 2%.

17. (Original) The method of claim 16, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue at least to about 1%.

18. (Original) The method of claim 1, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue to between 0 and about 10%.

19. (Original) The method of claim 18, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue to between 1 and about 5%.

20. (Previously Amended) The method of claim 1, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue to an amount effective to result in a half maximal or lower scattering coefficient μ_s' according to the equation $\mu_{tot}' = \mu_a + \mu_s'$, where μ_a is the absorption coefficient and μ_{tot}' is the total attenuation coefficient.

21. (Original) The method of claim 1, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the hematocrit of the blood associated with said at least a first tissue to an amount effective to result in a scattering coefficient of about half the scattering coefficient for whole blood or less.

22. (Original) The method of claim 1, wherein said low-scattering, oxygen-carrying blood substitute is a solution comprising at least a first oxygen carrier, and wherein the largest species in said solution has a size of about 6 nanometers.

23. (Original) The method of claim 1, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the scattering coefficient of the blood associated with said at least a first tissue to about one half of the scattering coefficient of whole blood or less at a sample wavelength of between about 600 nm and about 1500 nm.

24. (Original) The method of claim 23, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the scattering coefficient of the blood associated with said at least a first tissue to about one tenth of the scattering coefficient of whole blood or less at a sample wavelength of between about 600 nm and about 1500 nm.

25. (Original) The method of claim 23, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the scattering coefficient of the blood associated with said at least a first tissue to about one half of the scattering coefficient of whole blood or less at a sample wavelength of about 600 nm.

26. (Original) The method of claim 25, wherein provision of said low-scattering, oxygen-carrying blood substitute reduces the scattering coefficient of the blood associated with said at least a first tissue to about one tenth of the scattering coefficient of whole blood or less at a sample wavelength of about 600 nm.

27. (Original) The method of claim 23, wherein provision of said low-scattering, oxygen-carrying blood substitute decreases the scattering coefficient of the blood associated with said at least a first tissue to a scattering coefficient of about 0.4 mm^{-1} or less at about 1310 nm.

28. (Original) The method of claim 27, wherein provision of said low-scattering, oxygen-carrying blood substitute decreases the scattering coefficient of the blood associated with said at least a first tissue to a scattering coefficient of about 0.3 mm^{-1} or less at about 1310 nm.

29. (Original) The method of claim 28, wherein provision of said low-scattering, oxygen-carrying blood substitute decreases the scattering coefficient of the blood associated with said at least a first tissue to a scattering coefficient of about 0.2 mm^{-1} at about 1310 nm.

30. (Original) The method of claim 1, wherein said low-scattering, oxygen-carrying blood substitute is a solution comprising at least a first oxygen carrier, and wherein the refractive index of said oxygen carrier is substantially equal to other molecular species in solution.
31. (Original) The method of claim 1, wherein said low-scattering, oxygen-carrying blood substitute has at least about 70% of the oxygen carrying capacity of whole blood.

Claims 32- 56 (Cancelled).

57. (Original) The method of claim 1, wherein said at least a first tissue is neural tissue.
58. (Original) The method of claim 1, wherein said at least a first tissue is brain tissue.
59. (Original) The method of claim 1, wherein said at least a first tissue is located within a highly perfused organ.
60. (Original) The method of claim 59, wherein said at least a first tissue is located within the kidney, lung, liver, spleen, brain, heart or one of the great vessels.
61. (Original) The method of claim 1, wherein said at least a first tissue is cardiovascular tissue.
62. (Original) The method of claim 1, wherein said at least a first tissue is cardiac tissue.
63. (Original) The method of claim 1, wherein said at least a first tissue is a blood vessel.
64. (Original) The method of claim 63, wherein said optical imaging or treatment step is applied from the lumen of said blood vessel.
65. (Original) The method of claim 63, wherein said blood vessel has or is suspected to have an atherosclerotic plaque or lesion.
66. (Original) The method of claim 1, wherein said at least a first tissue comprises at least two tissue layers, and wherein at least a first of said tissue layers is associated with a substantial blood fraction.
67. (Original) The method of claim 66, wherein said at least a first tissue comprises a plurality of tissue layers, and wherein at least a first of said tissue layers is associated with a substantial blood fraction.
68. (Original) The method of claim 1, wherein said animal has, or is at risk for developing, a cardiac tissue or cardiac valve defect.
69. (Original) The method of claim 1, wherein said animal has suffered, or is at risk for developing, a heart attack.

70. (Original) The method of claim 1, wherein said animal has, or is at risk for developing, an ischemic tissue.

71. (Original) The method of claim 1, wherein said animal has suffered, or is at risk for developing, a stroke.

72. (Original) The method of claim 1, wherein said animal has, or is at risk for developing, a vascularized tumor.

73. (Original) The method of claim 1, wherein said animal is a mouse.

74. (Original) The method of claim 1, wherein said animal is a human subject.

75. (Original) A method for optical coherence tomography imaging of a tissue in an animal, which tissue comprises a substantial blood fraction, comprising: (a) introducing into said blood fraction of said tissue an amount of an essentially non-particulate hemoglobin solution effective to substantially reduce optical scattering from said blood fraction whilst substantially maintaining oxygenation in said tissue; and (b) performing optical coherence tomography imaging of said tissue.

76. (Previously Amended) A kit comprising a low-scattering, oxygen-carrying blood substitute and instructions for using said blood substitute in an optical imaging or light-based treatment method, wherein the low-scattering, oxygen-carrying blood substitute is selected to substantially reduce optical scattering from a blood fraction whilst substantially maintaining tissue oxygenation.

77. (Original) The kit of claim 76, wherein said instructions are written instructions.

78. (Original) The kit of claim 76, wherein said instructions are computerized instructions.

79. (Currently Amended) A method for performing optical imaging or treatment of a tissue in an animal, which tissue comprises a substantial blood fraction, comprising: (a) introducing into said blood fraction of said tissue an amount of a low-scattering, oxygen-carrying blood substitute effective to substantially reduce optical scattering from said blood fraction whilst substantially maintaining oxygenation in said tissue, wherein the low-scattering, oxygen-carrying blood substitute reduces the scattering coefficient of the blood associated with said at least a first tissue to about one half of the scattering coefficient of whole blood or less at a sample wavelength of between about 600 nm and about 1500 nm; and (b) applying an optical imaging or treatment step to said tissue.

80. (Currently Amended) A method for performing optical imaging of at least a first tissue in an animal, comprising providing into the blood associated with said at least a first tissue a biologically effective amount of a low-scattering, oxygen-carrying blood substitute, wherein the low scattering, oxygen carrying blood substitute includes a size less than about 80 nm to substantially reduce optical scattering, and applying an optical imaging step to said at least a first tissue.

81. (Currently Amended) A method of generating an image of at least a first vascularized tissue by in vivo diagnostic light imaging, comprising providing into the blood perfusing said vascularized tissue a biologically effective amount of a low-scattering, oxygen-carrying blood substitute, wherein the biologically effective amount results in a reduced scattering coefficient of whole blood to about 66% to 5%, and executing a diagnostic light imaging technique to generate an image of said vascularized tissue.

82. (Original) A method for optical coherence tomography imaging of at least a first tissue in an animal, comprising providing into the blood associated with said at least a first tissue a biologically effective amount of a substantially non-particulate hemoglobin solution, and performing optical coherence tomography imaging of said at least a first tissue.